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LORAIN

POWER EQUIPMENT

LORAIN MODEL RB2B

DC-DC CONVERTER

Spec. No. 5653-034 Serial No. _____

RB2B

INSTRUCTIONS

INSTALLATION

OPERATION

MAINTENANCE

RELIANCE COMM/TEC

LORAIN MODEL RB2B

DC-DC CONVERTER

Spec. No. 5653-034 Serial No. _____

LORAIN PRODUCTS
Division of Reliance Electric Co.

WARRANTY

Seller warrants that the products it manufactures or sells shall be free from defects in material and workmanship during the first 90 days after the product is activated. During said period, Seller will repair or replace any defective parts free of charge to Buyer, including any labor costs. In addition, Seller shall repair or replace any defective parts, so discovered by Buyer to be defective within two years from the date of shipment of same, provided Buyer promptly so notifies Seller. In no case shall Seller's liability under this warranty extend beyond two years from the date of shipment of said product. This warranty shall not apply to any products which are misused, modified, repaired, or otherwise abused by Buyer or others. The repair or replacement of defective parts, or the refund of the invoice cost thereof, as shall be determined by Seller in its sole discretion, shall be the limit of Seller's liability hereunder and shall be Buyer's sole and exclusive remedy.

Handling or service charges in connection with the return of such products, if approved by Seller, shall be charged as determined by Seller. Seller shall not be liable in any event for any general or special, incidental or consequential damages to Buyer in excess of the amount of the purchase price of the products.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES. SELLER MAKES NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE WITH RESPECT TO ANY PRODUCTS EXCEPT AS HEREIN EXPRESSLY PROVIDED.

SYSTEMS AND EQUIPMENT NOT ECONOMICALLY RETURNABLE TO THE FACTORY

In the event that the product involved is a system or equipment which, in the judgement of Lorain Products, is not economically returnable to the factory or if Lorain Products has performed the installation, supervised the installation, or performed testing and turn-on, circuit components and Lorain repair labor are covered by this warranty for the first 90 days from date of turn-on and circuit components are warranted for two years from the date of shipment. Upon request, Lorain will send a service technician to the site to determine if the unit is defective in circuit components or workmanship, and will repair the equipment. If the failure is Lorain's fault, no invoice for circuit components or repair labor will be issued if the complaint has been issued within the first 90 days from date of turn-on. If the complaint is issued more than 90 days from the date of turn-on but within two years from date of shipment, the customer will be billed at the prevailing Customer Service rates but will not be billed for circuit components. If the problem occurs after two years from the date of shipment, circuit component and repair labor are billable.

If the problem has been created by misuse or abuse of the equipment or by malfunction of associated equipment or by environmental conditions, at any time after shipment, the customer will be billed for circuit component and labor.

GENERAL PROVISIONS

Lorain Products shall not be obligated to pay any costs or charges incurred by the customer or by any other party. In no event will Lorain Products be liable for consequential damages. No waiver, alteration or modification of any of the provisions herein shall be binding on Lorain Products unless in writing and signed by an authorized official of Lorain Products. If, during any warranty period, the subject equipment has, in the opinion of Lorain Products, been modified or misrepaired, the warranty will be void unless the modifications or repairs have been made after consultation with Lorain Products and upon the recommendation of Lorain Products.

NOTE

Part Numbering System

LORAIN is expanding its part numbering system by adding two additional numbers to the previous seven digit numbering system. All part numbers can be converted to the new system by adding -00 to the end of the old part number. As an example, Part No. 5438-008 becomes Part No. 5438-008-00 when changed to the new system. Because of conversion time, both types of numbering systems may appear in this instruction manual.

Document Changes/Revisions

LORAIN is also changing the method used to indicate changes and minor revisions to drawings. The previous system used a number to denote major changes and an alpha character for minor revisions, such as typographical errors. The new system uses an alpha character for major changes and a number for minor revisions. As an example, a drawing with an Issue 1B becomes Issue A2 with the new system. Again, because of conversion time, both systems may be used in this manual. The following table should be used as a guide to conversion to the new system:

A - 1	G - 7	N - 13	U - 19
B - 2	H - 8	P - 14	V - 20
C - 3	J - 9	Q - 15	W - 21
D - 4	K - 10	R - 16	X - 22
E - 5	L - 11	S - 17	Y - 23
F - 6	M - 12	T - 18	Z - 24

LORAIN® MODEL RB2B DC TO DC CONVERTER
SPEC. NO. 5653-034-00

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1. INTRODUCTION

General

1.01 This DC to DC converter operates from nominal -48 volt input to provide filtered 48 volt DC output to the load. This converter is designed with a high frequency switching circuit and is equipped with an output current limit circuit. The output current limit circuit automatically limits output current to a fixed value, preventing damage to the converter during an overload condition.

2. INSTALLATION

Location

2.01 This DC to DC converter should be installed in a well ventilated area with an ambient temperature range of 0°C (+32°F) to +50°C (+122°F).

Mounting

2.02 This converter is designed for mounting in a 19 inch relay rack. Adapter plates are provided for 23 inch relay rack mounting. A maximim of six converters may be stacked, one above the other, with a minimum of 1-3/4 inch spacing.

WARNING

Ventilating openings at the top and bottom of the converter cabinet must be unobstructed and temperature of the air entering the cabinet must not exceed +50°C (+122°F). Refer to the Power Data sheet for spacing and baffle plate requirements.

Electrical Connections

2.03 The input, output, and alarm connection terminals are located behind the front panel of the converter cabinet. Refer to the Power Data sheet and the following description when installing the electrical connections.

a) Remove fuse F1 from the fuseholder at the front panel of the converter.

b) Loosen the two front panel captive fasteners and remove the front panel/top cover from the cabinet.

c) Perform the following input connections.

1) Connect the -48 VDC input lead to TB1 terminal 2, and the ground lead to TB1 terminal 1. The negative input lead should be externally fused following the recommendation in the Power Data sheet.

2) A jumper wire connects the positive (+) terminal of TB1 to the frame ground terminal. If desired, the jumper can be removed following installation.

d) Perform the following output connections.

1) Connect the positive output lead to TB2 terminal 2.

2) Connect the negative output lead to TB2 terminal 4.

e) The following terminal connections are provided for customer furnished external alarms. Refer to the Operation Section of this manual for functional descriptions.

1) If desired, connect ground activated external alarms to terminals 4 and 6 on terminal board TB1.

2) If desired, connect a closed loop activated alarm between terminals 7 and 8 or an open loop activated alarm between terminals 8 and 9 on terminal board TB1.

f) Replace the front panel/top cover and secure with the two retaining screws.

g) Replace the input fuse into the fuseholder on the front panel assembly. If battery power is available, the converter will start when the fuse is inserted into its fuseholder.

3. ADJUSTMENTS

General

3.01 All control potentiometers are located on the main control circuit card in the converter, and become accessible after removal of the cover. Of all the potentiometers located on the circuit card, only one is intended for user adjustment. Procedure for adjusting the output voltage is given in this section of the manual, and only this adjustment should be attempted by the user. Do not attempt to perform any adjustments not described in this section. Disturbing the settings of any factory-adjusted potentiometers will result in degraded equipment performance or complete failure. The equipment required for adjustment is listed as follows:

Test Equipment	Description
Digital Multimeter	Fluke Model 8022A, or equivalent
Alignment Tool	GC Electronics type 8728A, or equivalent

DANGER

All adjustments are performed while the converter is operating. Hazardous voltages capable of producing severe electrical shock may be present at the OUTPUT terminals (TB2) and at the OUTPUT POLARITY terminals. Exercise caution that contact is not made with any electrical termination, especially when connecting meter test probes. Remove watches, rings, and other jewelry before connecting test instruments and making adjustments. To further avoid the possibility of electrical shock or damage to the equipment, use only the insulated alignment tool recommended in the test equipment list when adjusting potentiometers.

Output Voltage Adjustment

3.02 Remove the front cover from the converter and observe the following procedure when adjusting output voltage.

a) Connect the test probes of a digital multimeter (DMM) to the output terminals on terminal board TB2, observing proper polarity. If desired, the test probes could alternately be connected at the load.

b) With the converter operating, insure that the output does not exceed the full load rating of the converter.

c) The voltage across the output terminals should measure within the range of 42 to 56 volts DC. If the output voltage is the desired value, perform Step f.

d) Locate the OUTPUT VOLTS ADJUST potentiometer accessible through the front panel of the converter.

e) Adjust the potentiometer either clockwise or counterclockwise to obtain the desired voltage, as indicated by the DMM.

f) When adjustment is completed, disconnect the DMM test probes and replace the cover on the converter cabinet.

4. OPERATION

General

4.01 This DC to DC converter operates from nominal -48 volt input to provide filtered 48 volt DC output to the load. Very little if any operator intervention is necessary following installation. Periodic maintenance and adjustments are not required.

Starting and Stopping

4.02 To start or stop converter operation, the preferred procedure is to connect or disconnect the customer provided external disconnect device. As an alternative, non-recommended procedure, the input fuse F1 can be removed from or inserted into the fuseholder located on the front panel of the converter.

Local Alarm

4.03 CONVERTER FAIL (DS1): The LED indicator labeled CONVERTER FAIL (DS1), located on the front panel of the converter, illuminates during a low voltage condition or a converter output failure.

Remote Alarms

4.04 Terminals 3 through 9 on terminal board TB1 can be connected to customer furnished remote alarms or indicators to monitor the operational status of the converter. During normal operation, ground is connected to terminals 3 and 5 of TB1, an open loop circuit is connected to terminals 8 and 9, and a closed loop circuit is connected between terminals 7 and 8. During a converter fail condition, ground is removed from terminals 3 and 5 and is connected to terminals 4 and 6. Simultaneously the closed loop circuit between terminals 7 and 8 opens and the open loop circuit between terminals 8 and 9 closes. The alarm terminals will automatically return to normal operating conditions when full power is restored to the converter. Refer to the Power Data sheet for terminal board location and terminal configuration.

Fuses

4.05 The converter contains a single input fuse which is accessible through the front panel of the converter. If necessary, replace with a 4 ampere fuse, Lorain Part No. 2483-236.

5. CIRCUIT DESCRIPTION

General

5.01 The Model RB2B is basically a feed forward DC to DC converter using pulse width modulation techniques for power control. The functional circuits include input and startup, pulse width modulator, power switching circuit, output circuit, output

voltage control and current limit control. The individual circuits are described in detail in the following text.

Input and Startup Circuit

5.02 The 48 volt DC input is supplied to the converter circuits through inductor L3 and fuse F1. Inductor L3 and capacitors C17 and C18 serve as high and low frequency noise filters for the DC input. An internal 15 VDC supply for integrated circuits and other circuit card components consists of R33 and zener diode CR9. At initial startup, transistor Q2 and associated components provides a high level DC signal of approximately 15 volts through CR8 to the control input of A2 at pin 6. Capacitor C10 charges at a controlled rate, reducing the DC signal level to A2. As C10 charges, the output pulse width of A2 gradually widens so the output power level of the converter gradually increases to normal output from an initial zero level. After C10 is fully charged, the DC control signal has no further effect on the operation of A2.

Pulse Width Modulator

5.03 The pulse width modulator circuit consists of integrated circuit A2, controlled by the output voltage and current regulators. The basic operating frequency of A2 is determined by R27, R28 and capacitor C8. Potentiometer R28 allows the operating frequency to be adjusted within a specific range. The output from A2 on pin 11 is a variable duty cycle square wave used as a drive signal by the power switching circuit. The control voltage applied to pin 6 of A2 affects the output duty cycle such that a more positive signal decreases the duty cycle.

Power Switching Circuit

5.04 The power switching circuit consists of transistors Q3 through Q5 and power transformer T1. This circuit chops the input DC into a high frequency square wave which alternates between high (positive) and low (common) states. During circuit operation with the drive signal on pin 11 of A2 in a low state, transistor Q3 is biased off. Base current for Q4 and Q5 connected in a Darlington configuration, flows through resistor R38 and biases Q4 and Q5 into conduction. When Q4 and Q5 conduct, current flows through the primary winding of T1. When the drive signal to the base of Q3 switches to a high state, Q3 is biased into conduction. Current flows through a tertiary winding of T1 through resistor R38, thus diverting the base current from Q4 and Q5. The voltage developed across the 5 to 6 winding of T1 is rectified by CR16 to charge capacitor C13. The polarity of the charge on C13 is such that a negative voltage is impressed on the base of Q4. The combination of reduced base current and application of negative voltage biases Q4 and Q5 into cutoff which stops current flow through the primary windings of T1. The alternating current flow and cutoff through the primary winding of T1 develops a square wave which is impressed across the secondary windings.

Output Circuit

5.05 The +48 volt output circuit uses conventional rectification and filtering techniques. Square wave AC voltage developed across the 9 to 10 secondary winding of T1 is rectified by CR22. The pulsating DC is then filtered by L2, L4, C20 and C25 and applied as pure DC to output terminal board TB2.

Output Voltage Control

5.06 The 48 volt output is controlled by an error amplifier consisting of A1 and associated components. Voltage from the 7 to 8 secondary winding of T1 is rectified, filtered, then sampled across a voltage divider consisting of R4 and R5. A portion of this voltage is applied to the non-inverting input of error amplifier A1 through resistor R7. Amplifier A1 compares the sampled voltage with a reference voltage generated by A2. A portion of this voltage is applied to the inverting input of A1 through the slider contact of R2. Any difference between the voltage values applied to inputs 12 and 13 of A1 is amplified and applied to the control input, pin 6, of A2 as a control voltage. This control voltage is of proper polarity and amplitude to either increase or decrease the

drive signal pulse width for input voltage, output voltage, and load conditions. The resulting increase or decrease of the power level regulates the output voltage within close limits for input voltage changes, and maintains the 48 volt output within wider limits for changes in load current.

Current Limit Control

5.07 The input current through the primary winding of T1 is continuously monitored through the current transformer. The AC signal developed across one winding of the current transformer is rectified by CR1, then applied to peak charging diode CR2 and capacitor C5. The voltage developed at the junction of CR2 and C5 is nearly pure DC which changes in value according to the input current in T1. An operational amplifier in A1 accepts the current information signal at the noninverting input pin 5. A reference signal, generated by A2, is applied across a voltage divider consisting of R13 and R15, then through R16 to the inverting input pin 6 of A1. When the voltage level of the current information signal on pin 5 exceeds the reference value on pin 6, operational amplifier A1 outputs a control voltage to pin 6 of A2 through diode CR4. When an overload condition exists at the converter output which demands excessive current through T1, the voltage signal on the output of the current limit circuit becomes more positive with respect to the signal generated by the voltage regulator. This current limit drive signal applied to A2 results in a decrease of drive signal duty cycle which decreases input current to T1, thus reducing operation to a safe value. The current limit control signal decreases to a normal operating value when the overload condition is cleared, allowing the output voltage control circuits to regulate the output voltage.

Alarm Circuits

5.08 The converter fail alarm circuit activates when voltage on the secondary of the power transformer is less than 40 volts. During normal operation, voltage across the 7 to 8 secondary winding of T1 maintains the coil of relay K1 in an energized state. As long as K1 remains energized, an open contact exists in series with the DS1 indicator, the contacts between ground and terminals 4 and 6 on TB1 are open and an open loop circuit exists between terminals 8 and 9 on TB1. If the voltage developed across the secondary winding of T1 decreases sufficiently to deenergize the K1 relay coil, the contacts will release, which results in negative battery being supplied to the DS1 indicator, a closed circuit between ground and terminals 4 and 6, and a closed loop circuit between terminals 8 and 9. The alarms will automatically deactivate when the voltage across the secondary of T1 is sufficient to energize the coil of relay K1.

APPENDIX

RECORD OF INSTRUCTION CHANGES		
ISSUE OR DATE	ECN	DESCRIPTION OF CHANGE
1	-	NEW
		CONVERSION TO LAMPS
B1	183-8870	Removed references to low battery shutdown circuit - paragraph 1.01, 4.03, and 5.01. Low battery shutdown circuit description removed; paragraph 5.08 was 5.09.

LORAIN PRODUCTS

1122 F Street, Lorain, Ohio 44052
(216) 288-1122/TRT: 196131 LORN UT/WUD: 980505 (LORN PROD LORN)

In Canada —
Reliance Telecommunication Products Ltd., 122 Edward St., St. Thomas, Ont.
TEL. 519-631-0780/TWX. 610-356-6703 (LORAIN PRODCAN)

In Mexico —
Productos Lorain de Mexico, S.A. de C.V., Apartado Postal 77001
TEL. 576-82-77/TLX./01774308 (1774308 LORME)

RELIANCE COMM/TEC

RECOMMENDED SPARE PARTS LIST
LORAIN MODEL RB2B DC/DC CONVERTER
SPEC. NO. 5653-034-00

This Electrical Parts List is arranged alphabetically by part name. Spare parts are not usually required if adequate standby equipment is available and if the LORAIN equipment is installed at an accessible location so that parts can be readily obtained from Lorain Products stock. The ON-SITE quantity of spare parts will be sufficient for most repairs and should be sufficient for ten or less assemblies or models for at least 18 months. The DEPOT quantity is a more complete set of spare parts for remote areas or service for a number of sites. When ordering parts, please furnish equipment Model No., Spec. No., and Serial No. as given on the equipment nameplate.

LPC Part Number	Description	Quantity of Recm. Spares ON-SITE	DEPOT
ASSEMBLIES			
4338-450-00	PWM CON/PW Bd PW Assembly	0	1
FUSES			
2483-236-00	Cartridge, 4A	0	1
MAGNETIC UNITS			
4423-513-00	Inductor, DC Filter	0	1
4481-042-00	Transformer, Power	0	1
RESISTORS			
2656-515-00	Fixed, 500 Ohm 25W	0	1
MISCELLANEOUS			
2488-059-00	Fuseholder, 250V 16A	0	1
2668-210-00	Bkt Mtg Res, 25W	0	1

AM/cvb

LORAIN PRODUCTS

1122 F Street, Lorain, Ohio 44052
(216) 288-1122/TRT: 196131 LORN UT/WUD: 980505 (LORN PROD LORN)

In Canada —
Reliance Telecommunication Products Ltd., 122 Edward St., St. Thomas, Ont.
TEL. 519-631-0780/TWX. 610-356-6703 (LORAIN PRODCAN)

In Mexico —
Productos Lorain de Mexico, S.A. de C.V., Apartado Postal 77001
TEL. 576-82-77/TLX./01774308 (1774308 LORME)

RELIANCE COMM/TEC

1. SPECIFICATION

1.1 **GENERAL:** This DC to DC Converter changes 48 volts DC positive ground input to 48 volts DC output for either positive or negative grounded systems.

1.2 **OUTPUT RATINGS**

1.2.1 **Voltage:** Positive 48 volts DC nominal. Adjustable over the range of 44 to 52 volts.

1.2.2 **Regulation**

(A) **Line:** Output voltage remains within ±2% of the adjusted voltage for any input voltage within the specified range.

(B) **Line and Load Combined:** Output voltage remains within the range of 45 to 51 VDC for any combination of input voltage within the specified range and load current from no load to full load.

1.2.3 **Filtering:**

(A) **Voice Band:** Noise is less than 32dBrn C message. Refer to Para. 1.7.1.

(B) **Wide Band:** Noise within the frequency range from DC to 20 MHz does not exceed 30 millivolts rms or 0.5 volt peak to peak. Refer to Para. 1.7.1.

1.2.4 **Current:** 2 amperes, full load

1.3 **INPUT RATINGS**

1.3.1 **Voltage:** 48 volts DC positive ground, with operational range of 42 to 56 volts DC. This converter will tolerate a range of 40 to 60 volts DC with no adverse effects.

1.3.2 **Typical Input Data** (output adjusted to 48 VDC at 50% load with 50 VDC input):

DC Input Voltage	Input Amperes	Percent Load	Output Voltage	Percent Efficiency
42	0.23	0	49.80	-
	1.48	50	47.94	77.4
	2.73	100	46.28	80.8
50	0.22	0	49.75	-
	1.27	50	48.00	75.5
	2.32	100	46.36	79.8
56	0.23	0	49.76	-
	1.16	50	48.06	73.7
	2.10	100	46.42	79.0

1.3.3 **Maximum Input Current:** Does not exceed 2.8 amperes at 100% load with input voltage of 42 VDC.

1.3.4 **Filtering:**

(A) **Voice Band:** Noise reflected into a 240 ampere hour battery is less than 22 dBrn C. Refer to Para. 1.7.1.

(B) **Wide Band:** Within the frequency range from DC to 20 MHz, maximum noise appearing at the input terminals does not exceed 100 millivolts rms or 0.5 volt peak to peak. Refer to Para. 1.7.1.

ISSUE	CHG NO	DESCRIPTION
B1	183-8870	MAR 1 1985 BP REFERENCES TO LOW BATTERY SHUTDOWN OPERATION REMOVED FROM PARA. 1.4.1 AND 1.4.5 Y.J. Thom 3-1-85 CONVERSION TO L.A.M.P.S.
1	—	NEW OCT 11 1984 BP

REVISIONS

LORAIN PRODUCTS
LORAIN, OHIO
RELIANCE COMM/TEC

POWER DATA

MODEL R82B DC TO DC CONVERTER

SPEC. NO. 5653-034-00

DR BY	DATE	APP'D/DR	DATE	
R. LASH	9-26-84	A. Weimer	10-4-84	PD5653-034-00
CH BY	DATE	APP BY	DATE	
		Y.J. Thom	9-26-84	
ENGR BY	DATE			PAGE 1 OF 5
J. Kaliver	9-24-84			

1. SPECIFICATION

1.4 STANDARD FEATURES

1.4.1 **Input Protection:** DC input fuse opens the negative input lead. This input lead should be fused externally according to the recommendation of INSTALLER'S INFORMATION NOTE 4.1.

1.4.2 **Output Protection:** Nonadjustable straight line current limiting protects converter against overloads. Maximum overload ouput current does not exceed 4 amperes.

1.4.3 **Audible Noise:** Operating frequency beyond audible range.

1.4.4 **Series Output Diode:** Series output diode, which enables paralleling with other converters, is connected in positive output lead. Load may not be shared proportionally between parallel connected units.

1.4.5 **Converter Fail Alarm:** If the DC input fuse opens for any reason, indicator CONVERTER FAIL illuminates, one closed loop alarm circuit is available at TB1 terminals 8 to 9 and two extended ground alarm circuits are available at TB1 terminals 4 and 6.

1.4.6 **Mounting:** Angles permanently attached to cabinet for 19 inch relay rack mounting. Adapter plates are provided for 23 inch rack mounting. Both angles and adapter plates are suitable for use in 1 inch multiple drilling racks.

1.5 ENVIRONMENTAL RATINGS

1.5.1 **Operating Ambient Temperature Range:** 0°C to +50°C (+32°F to +122°F)

1.5.2 **Storage Temperature Range:** -40°C to +65°C (-40°F to +149°F)

1.5.3 **Heat Dissipation:** 84 btu/hr (56 volt input at 48 volt output and full load)

1.5.4 **Ventilation Requirements**

(A) **Ventilation:** This converter should be mounted so bottom and top ventilating openings are not blocked and temperature of the air entering the bottom of the cabinet does not exceed +50°C (+122°F).

(B) **Spacing:** It may be necessary to allow a minimum of 1 3/4" spacing between this converter and other heat producing equipment.

(C) **Stacking:** A maximum of six converters may be stacked, one above the other, with 1 3/4" minimum spacing. Additional converters may be stacked if a baffle plate or increased spacing is used.

1.6 MISCELLANEOUS

1.6.1 **Schematic Diagram:** SD-5653-034-00

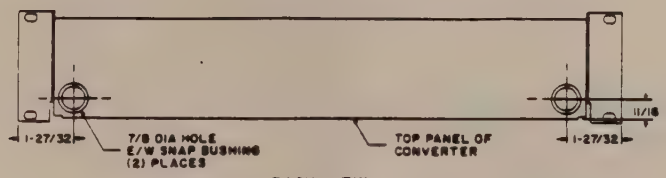
1.6.2 **Wiring Diagram:** T-5653-034-00

1.6.3 **Instructions:** Section 4595

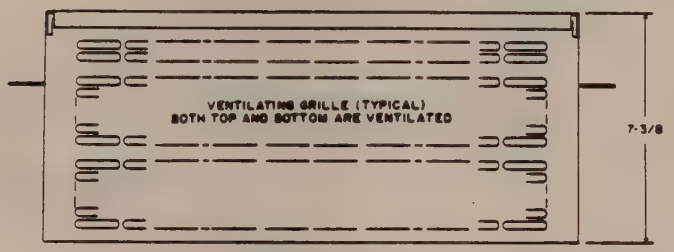
1.7 SPECIFICATION NOTES

1.7.1 This parameter is guaranteed by Engineering Design and test. Parameter is not production tested.

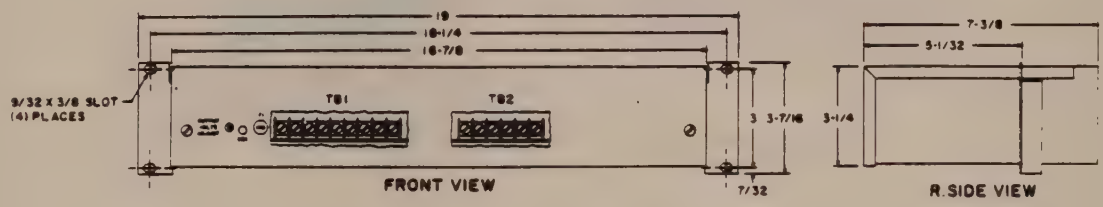
2. DIMENSIONS



BACK VIEW



TOP VIEW



FRONT VIEW

R.SIDE VIEW

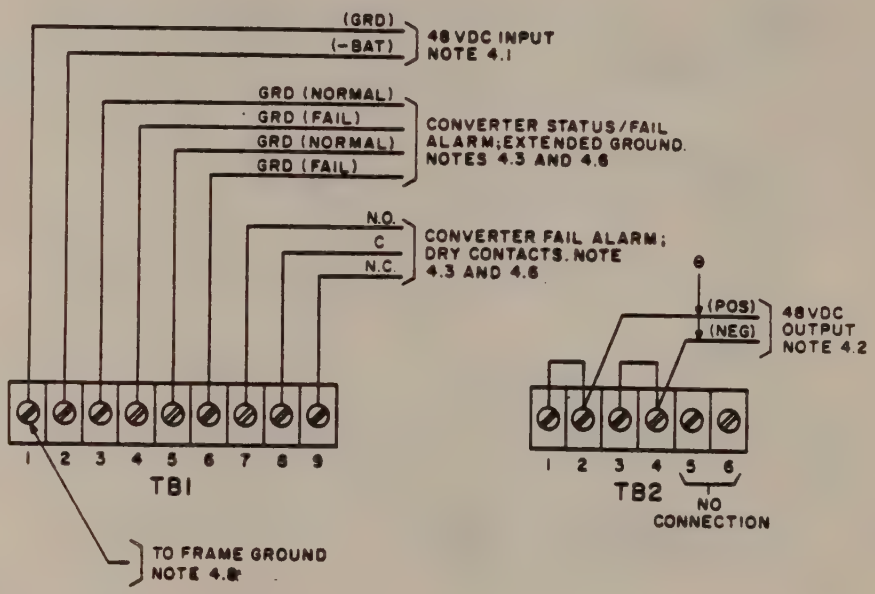
NOTES:

1. ALL DIMENSIONS IN INCHES
   UNLESS OTHERWISE SPECIFIED.

2. FINISH: EQUIPMENT LIGHT GRAY

3. WEIGHT:
   SHIPPING: LBS.
   NET: 8 LBS.

3. INSTALLER'S CONNECTIONS



4. INSTALLER'S INFORMATION NOTES

4.1

DC INPUT (TB1)				
Terminals		Loop Length - Ft (Note 4.4)	Recm Wire Size (Note 4.5)	Recm Fusing
Capacity	Type			
14 Ga. Max.	8-32 Screw	86	16 Ga.	6 amperes

4.2

DC OUTPUT (TB2)			
Terminals		Loop Length - Ft (Note 4.4)	Recm Wire Size (Note 4.5)
Capacity	Type		
14 Ga. Max.	8-32 Screw	116	16 Ga.

4.3

ALARMS (TB1)		
Terminals		Recm Wire Size
Capacity	Type	
14 Ga. Max.	8-32 Screw	18 Ga.

4.4 DC wire sizes are sufficient to restrict the voltage drop to one volt or less at full rated current for the loop lengths shown. The loop length is the sum of the positive and negative lead lengths.

4.5 Wire sizes based on recommendations of National Electric Code Table 310-16 for copper wire at 90°C conductor temperature, operating in ambient of 30°C. For operation in ambient higher than 30°C, apply derating factors listed in Table 310-16 of National Electric Code.

4.6 An alarm condition within the converter connects ground at terminals 4 and 6 of TB1, and provides one closed loop circuit at terminals 8 to 9 of TB1. These contacts are rated at 1 ampere, 24 VDC or 0.5 ampere, 110 VAC for resistive loads.

4.7 ⊖ indicates wiring furnished and installed by the customer.

4.8 Positive ground to chassis provided by jumper. Removal optional after installation.

0 1 2 3 4

A

B

C

D

E

F

G

H

CIRCUIT NOTES

101. +GND INPUT CONNECTED TO FRAME GROUND TO PROTECT CONVERTER AGAINST BATTERY REVERSAL. REMOVAL OPTIONAL AFTER INSTALLATION.

102. T1, L2, & R42 ARE NOT LOCATED ON A1 POWER BOARD ASSEMBLY.

0 1 2 3 4

PRODUCT REVISIONS			
ECN	CHG SLIP NO. CHGD BY	DATE	DESCRIPTION
1		OCT 11 1984	BP

CONVERSION TO L.A.M.P.S.

BI 1838870 3-5-85 T.F.M.

R18 WAS 825 OHM, R19 WAS 2.21K

MAR 8 1985, BP A. Wehman

J Tasker 3/7/85M 3/7/85

EQUIPMENT NOTES

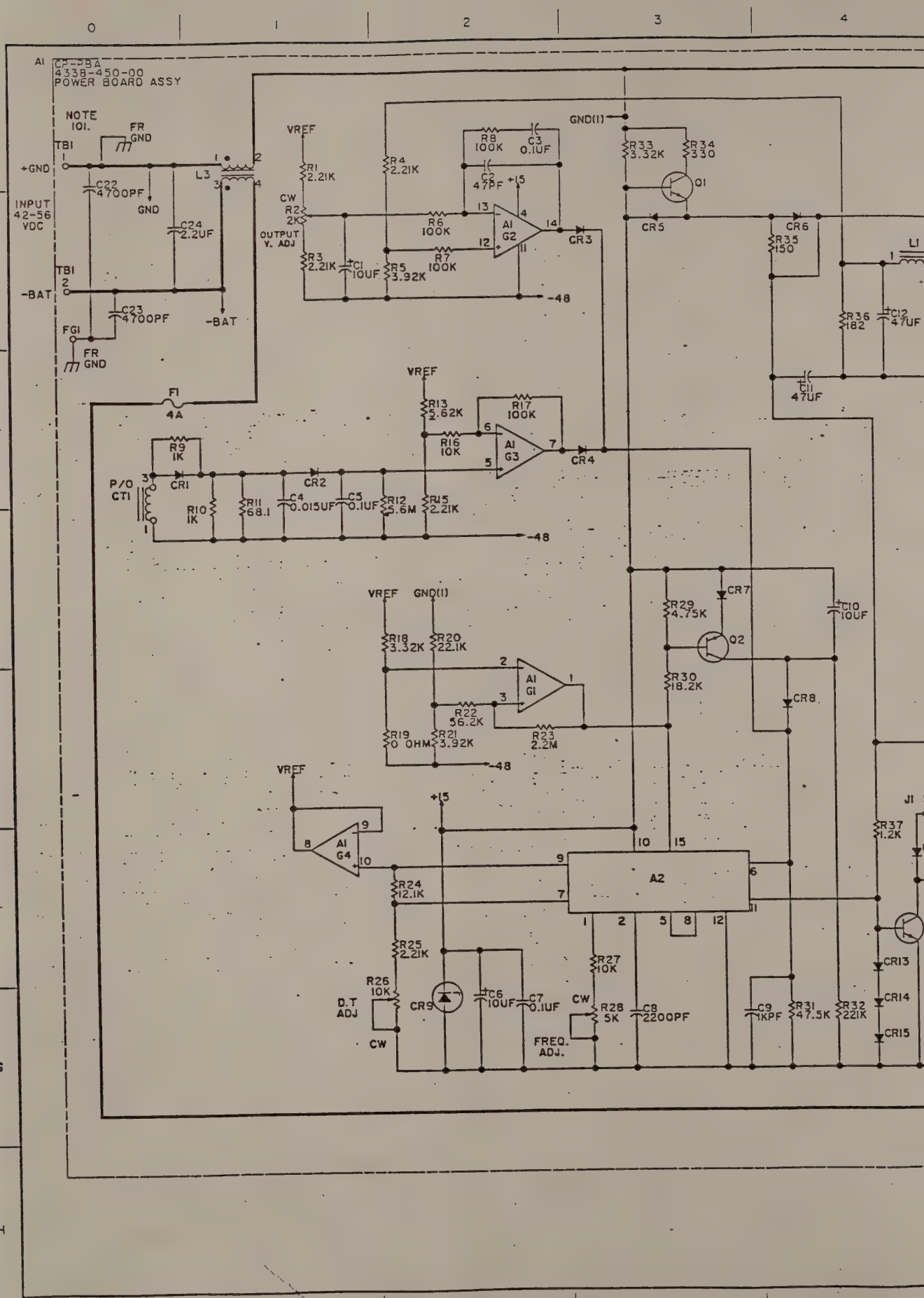
201.

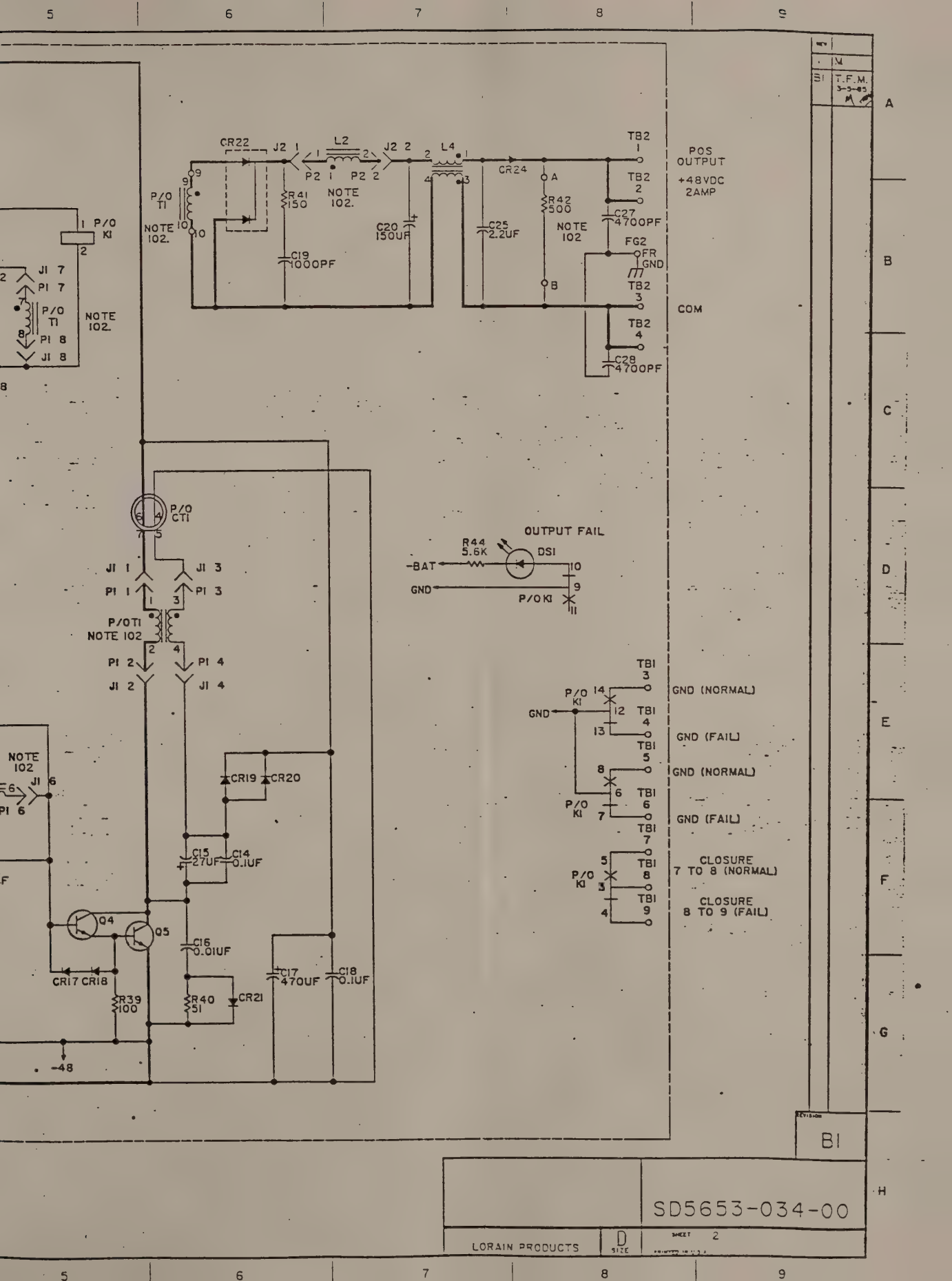
INFORMATION NOTES

301. UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICRO-FARADS & VALUES PRECEDED BY THE SYMBOL + (PLUS) OR − (MINUS) ARE IN VOLTS.

302. CODES SHOWN AS 4338-450-00 REPRESENT LORAIN PART NUMBERS.

1817282 CADD	DESIGNED J.KALIVAS	ECO BI
SCHEMATIC DIAGRAM FOR RB2B	DRAWN BY D.CHEVALIER	DATE 9-13-84
	CHECKED BY F.STULLER	DATE 10-9-84
	CHECKED BY	DATE
	APPROVED BY A. WEHMAN	DATE 10-11-85
	RATING STANDARD	
LORAIN PRODUCTS LORAIN, OHIO RELIANCE COMM/TEC	DWG SIZE D	SD5653-034-00
	SHEET 1 OF 2	


A1
CP-58A
4338-450-00
POWER BOARD ASSY
NOTE 101.
FR GND
TB1
+GND
INPUT 42-56 VDC
-BAT
FG1
C22 4700PF
C24 2.2UF
C23 4700PF
L3
GND
VREF
R1 2.21K
R4 2.21K
R8 100K
C3 0.1UF
C2 47PF
+15
CW
R2 2K
OUTPUT V. ADJ
R3 2.21K
C1 10UF
R5 3.92K
R6 100K
R7 100K
A1 G2
CR3
-48
GND(1)
R33 3.32K
R34 330
Q1
CR5
CR6
R35 150
L1
R36 182
C12 47UF
C11 47UF
F1 4A
R13 5.62K
R17 100K
R16 10K
A1 G3
CR4
R9 1K
P/O CT1
CR1
CR2
R10 1K
R11 68.1
C4 0.015UF
C5 0.1UF
R12 5.6M
R15 2.21K
R18 3.32K
R20 22.1K
A1 G1
R22 56.2K
R19 0 OHM
R21 3.92K
R23 2.2M
CR7
R29 4.75K
Q2
C10 10UF
R30 18.2K
CR8
A1 G4
R24 12.1K
A2
J1
R37 1.2K
R25 2.21K
R26 10K
D.T ADJ
CR9
C6 10UF
C7 0.1UF
FREQ. ADJ.
R27 10K
R28 5K
C8 2200PF
C9 1KPF
R31 47.5K
R32 221K
CR13
CR14
CR15


CR22
J2 1
L2
J2 2
L4
CR24
TB2 1
POS OUTPUT
+48VDC 2AMP
TB2 2
C27 4700PF
FG2
FR
GND
TB2 3
COM
TB2 4
C28 4700PF
P/O T1
NOTE 102.
R41 150
NOTE 102.
C19 1000PF
C20 150UF
C25 2.2UF
R42 500
NOTE 102
P/O K1
J1 7
P1 7
P1 8
J1 8
P/O CT1
OUTPUT FAIL
R44 5.6K
DS1
-BAT
GND
P/O K1
J1 1
J1 3
P1 1
P1 3
P/O T1
NOTE 102
P1 2
P1 4
J1 2
J1 4
TB1 3
GND (NORMAL)
TB1 4
GND (FAIL)
TB1 5
GND (NORMAL)
TB1 6
GND (FAIL)
TB1 7
CLOSURE 7 TO 8 (NORMAL)
TB1 8
CLOSURE 8 TO 9 (FAIL)
TB1 9
NOTE 102
J1 6
P1 6
CR19
CR20
C15 27UF
C14 0.1UF
Q4
Q5
C16 0.01UF
CR17
CR18
R39 100
R40 51
CR21
C17 470UF
C18 0.1UF
-48
B1
T.F.M. 3-3-05
SD5653-034-00
LORAIN PRODUCTS
D SIZE
SHEET 2

UNIT QTY.	REF. DESIG.	PART NO.	PART DESCRIPTION		
1	L1	2413-124	CHOKE		
1	CT1	2413-281	CURRENT TRANSF		
1	F1	2483-236	4A. 250V		
1	K1	2543-428	4C. 24VDC. 1200		
1	R34	2615-251	330	1/2W	
1	R23	2615-343	2.2M	1/2W	
1	R12	2615-353	5.6M	1/2W	
1	R44	2615-476	5.6K	1W	
1	R11	2634-555	68.1	1/4W	
1	R39	2634-557	100	1/4W	
2	R10	2634-597	1K	1/4W	
	R9	2634-597	1K	1/4W	
5	R1	2634-614	2.21K	1/4W	
	R15	2634-614	2.21K	1/4W	
	R25	2634-614	2.21K	1/4W	
	R3	2634-614	2.21K	1/4W	
	R4	2634-614	2.21K	1/4W	
1	R18	2634-623	3.32K	1/4W	
2	R21	2634-627	3.92K	1/4W	
	R5	2634-627	3.92K	1/4W	
1	R29	2634-632	4.75K	1/4W	
1	R13	2634-636	5.62K	1/4W	
2	R16	2634-648	10K	1/4W	
	R27	2634-648	10K	1/4W	
1	R24	2634-652	12.1K	1/4W	
1	R30	2634-662	18.2K	1/4W	
1	R20	2634-665	22.1K	1/4W	
1	R31	2634-681	47.5K	1/4W	
1	R22	2634-684	56.2K	1/4W	
4	R17	2634-696	100K	1/4W	
	R6	2634-696	100K	1/4W	
	R7	2634-696	100K	1/4W	
	R8	2634-696	100K	1/4W	
1	R32	2634-714	221K	1/4W	
1	R35	2635-557	150	1W	
1	R36	2635-563	182	1W	
1	R33	2635-653	3.32K	1W	
1	R40	2651-148	51	3W	
1	R38	2651-177	510	3W	
1	R37	2651-337	1.2K	3W	
1	R41	2651-515	150	6.5W	
1	R19	2668-601	0	1/4W	
1	R2	2674-323	2K	3/4W. POT	
1	R28	2675-118	5K	1/2W. POT	
1	R26	2675-119	10K	1/2W. POT	
1	C4	2713-219	0.015UF	200VDC	
1	C16	2713-309	0.01UF	400VDC	
3	C13	2715-131	2.2UF	100VDC	
	C24	2715-131	2.2UF	100VDC	
	C25	2715-131	2.2UF	100VDC	
2	C14	2724-090	0.1UF	100VDC	
	C18	2724-090	0.1UF	100VDC	
2	C19	2724-139	1KPF	1000VDC	
	C9	2724-139	1KPF	1000VDC	
1	C2	2724-145	47PF	1000VDC	
4	C22	2724-158	4700PF	1000VDC	
	C23	2724-158	4700PF	1000VDC	
	C27	2724-158	4700PF	1000VDC	
	C28	2724-158	4700PF	1000VDC	
3	C3	2724-509	0.1UF	50VDC	
	C5	2724-509	0.1UF	50VDC	
	C7	2724-509	0.1UF	50VDC	
1	C8	2724-555	2200PF	50VDC	
3	C1	2731-070	10UF	50VDC. ELECT.	
	C10	2731-070	10UF	50VDC. ELECT.	
	C6	2731-070	10UF	50VDC. ELECT.	
2	C11	2731-125	47UF	50VDC. ELECT.	
	C12	2731-125	47UF	50VDC. ELECT.	
1	C20	2731-159	150UF	60VDC. ELECT.	
1	C17	2731-178	470UF	60VDC. ELECT.	
1	C15	2731-619	27UF	200VDC. ELECT.	
8	CR1	2811-101	1N4148		
	CR2	2811-101	1N4148		
	CR3	2811-101	1N4148		
	CR4	2811-101	1N4148		
	CR5	2811-101	1N4148		
	CR6	2811-101	1N4148		
	CR7	2811-101	1N4148		
	CR8	2811-101	1N4148		
8	CR10	2812-220	RGP15D		
	CR11	2812-220	RGP15D		
	CR12	2812-220	RGP15D		
	CR16	2812-220	RGP15D		
	CR18	2812-220	RGP15D		
	CR19	2812-220	RGP15D		
	CR20	2812-220	RGP15D		
	CR21	2812-220	RGP15D		
4	CR13	2812-522	1N5402		
	CR14	2812-522	1N5402		
	CR15	2812-522	1N5402		
	CR17	2812-522	1N5402		
1	CR24	2813-035	MR756		
1	DS1	2818-125	LED. RED		
1	CR22	2821-806	TG284		
1	CR9	2836-235	1N4744A		15V
1	Q1	2842-035	NPN		
1	Q4	2842-058	NPN		
1	Q3	2842-100	NPN		
1	Q5	2842-170	2N6340		
1	Q2	2843-110	2N5400		
1	A1	2871-115	QUAD OPAMP		
1	A2	2873-115	P.W.M.		
2	L3	4431-112	INDUCTOR		
	L4	4431-112	INDUCTOR		

MANUFACTURING REFERENCES

CATEGORY	NUMBER
ASSEMBLY DRAWING	4338-450-00
P.W.BOARD	3155-653-00
CONNECTOR ON FRAME	

SYMBOL

SHOWN IN DETAIL ON FS

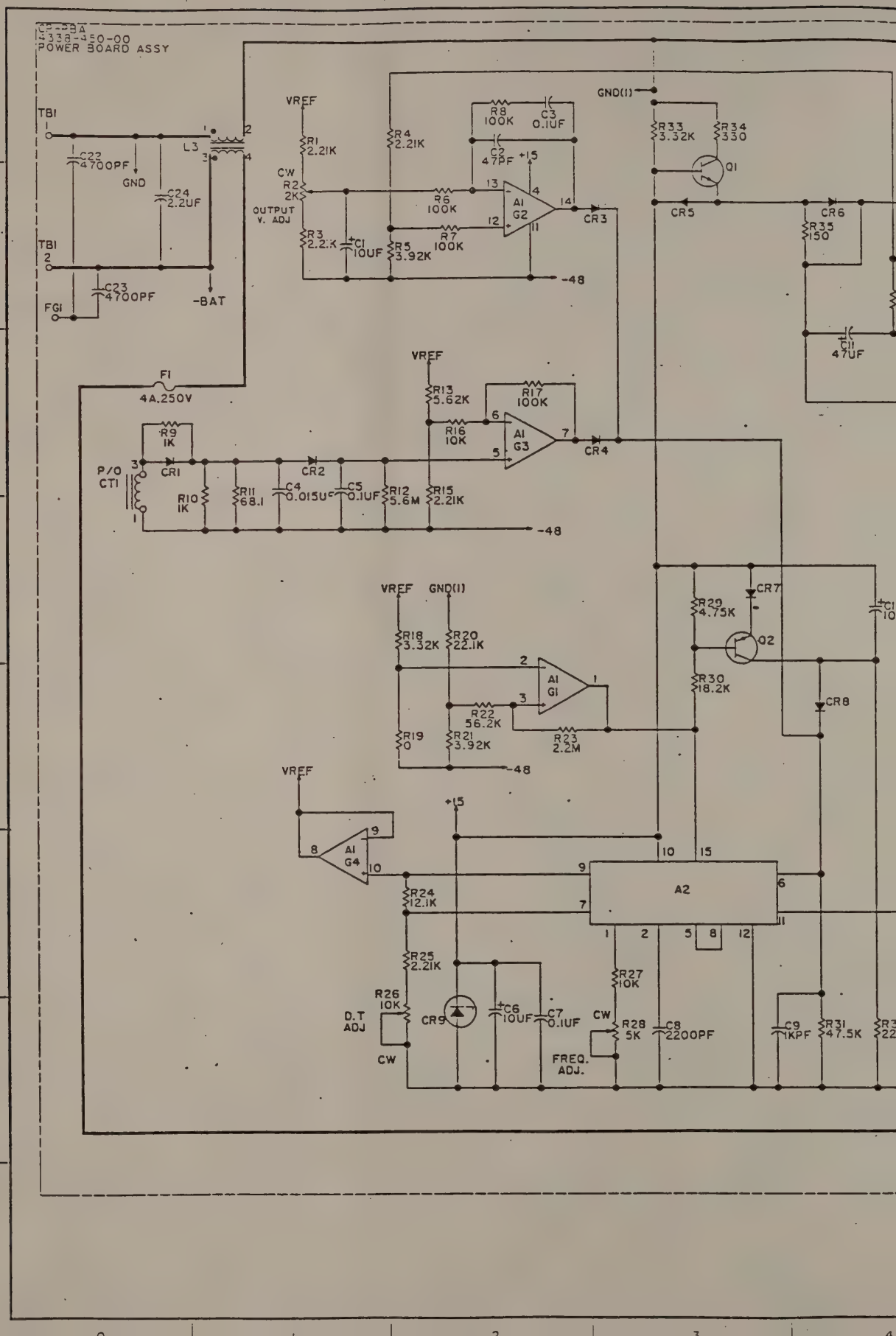
ISSUE CHANGES & REVISIONS

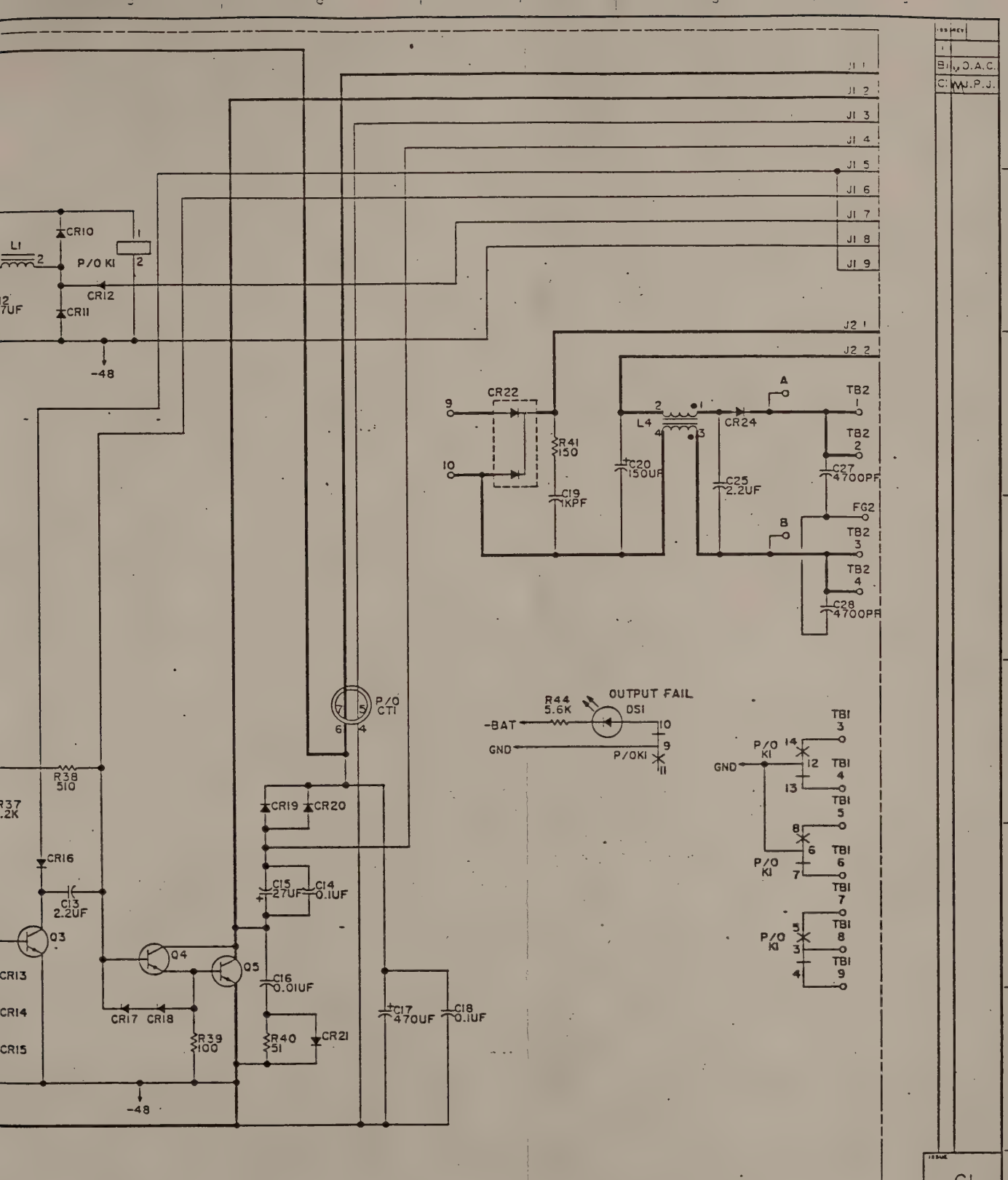
ISS NO	PCN	CHG SLIP NO CHKD BY	DATE	DESCRIPTION
1			OCT 1984	BP M
				CONVERSION TO L.A.M.P.S.
B1		1838870.	3-1-85	D.A.C.
		R18 WAS 2634-594		CH
		R19 WAS 2634-614		TFM
		J.RADER A.WEHMAN		3-6-85
		3-6-85 3-7-85	M	MAR 8 1985
C1		1839497	7-10-86	J.P.J.
		C13.C24.C25 WERE 2715-129		
		J Rader 7-15-86		J R Spahr
		SEP 16 1986 BP M		7-10-86

NOTES

1. UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS. VALUES PRECEDED BY THE SYMBOL +(PLUS) OR -(MINUS) ARE IN VOLTS
2. CODES SHOWN AS. 2413-124 REPRESENT LORAIN PART NUMBERS

1817282	CAD	DESIGNED BY J.KALIVAS	ISS C1
SCHEMATIC DIAGRAM FOR POWER BOARD ASSY		DRAWN BY D.CHEVALIER	DATE 7-23-84
		CHECKED BY E.STULLER	DATE 10-9-84
		CHECKED BY A WEHMAN	DATE 10-11-84
		APPROVED BY	DATE
		RATING STANDARD	
		SD4338-450-00	
LORAIN PRODUCTS LORAIN, OHIO RELIANCE COMM/TEC		DWG SIZE D	SHEET 1 OF 2


CB-5BA
4338-450-00
POWER BOARD ASSY
TBI
C22 4700PF
GND
C24 2.2UF
L3
C23 4700PF
FGI
-BAT
VREF
R1 2.21K
CW
R2 2K
OUTPUT V. ADJ
R3 2.2K
C1 10UF
R4 2.21K
R5 3.92K
R8 100K
C3 0.1UF
C2 47PF
+15
R6 100K
R7 100K
A1 G2
CR3
-48
GND(1)
R33 3.32K
R34 330
Q1
CR5
CR6
R35 150
C11 47UF
FI 4A.250V
R13 5.62K
R17 100K
R16 10K
A1 G3
CR4
R9 1K
P/O CTI
CR1
R10 1K
R11 68.1
CR2
C4 0.015UF
C5 0.1UF
R12 5.6M
R15 2.21K
VREF
GND(1)
R18 3.32K
R20 22.1K
A1 G1
R22 56.2K
R19 0
R21 3.92K
R23 2.2M
-48
CR7
R29 4.75K
Q2
R30 18.2K
CR8
C11 10
VREF
A1 G4
+15
A2
R24 12.1K
R25 2.21K
R26 10K
D.T ADJ
CW
CR9
C6 10UF
C7 0.1UF
R27 10K
CW
R28 5K
FREQ. ADJ.
C8 2200PF
C9 1KPF
R31 47.5K


J1 1
J1 2
J1 3
J1 4
J1 5
J1 6
J1 7
J1 8
J1 9
J2 1
J2 2
CR10
P/O K1
CR12
CR11
-48
CR22
R41 150
C19 1KPF
C20 150UF
L4
CR24
C25 2.2UF
TB2 1
TB2 2
C27 4700PF
FG2
TB2 3
TB2 4
C28 4700PF
P/O CT1
R44 5.6K
OUTPUT FAIL
DS1
-BAT
GND
P/O K1
TB1 3
TB1 4
TB1 5
TB1 6
TB1 7
TB1 8
TB1 9
R38 510
CR19
CR20
CR16
C13 2.2UF
C15 27UF
C14 0.1UF
Q3
Q4
Q5
C16 0.01UF
CR13
CR14
CR15
CR17
CR18
R39 100
R40 51
CR21
C17 470UF
C18 0.1UF
-48
Bly D.A.C.
C. W.J.P.J.
C1
SD4338-450-00
LORAIN PRODUCTS
D
SHEET 2

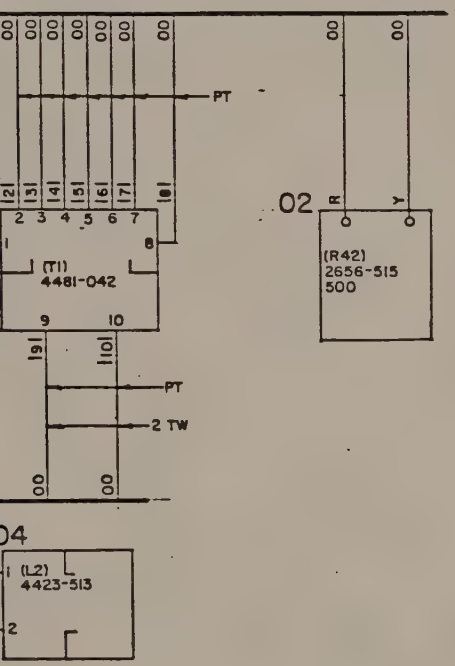
| SD-DRAWING ISSUES AND T-DRAWING ISSUES AS FOLLOWS: | | |

MANUFACTURING NOTES:

1. ALL WIRING TO BE 20 GA JUMPERS, UNLESS OTHERWISE SPECIFIED.
2. PT-LEADS WHICH ARE PART OF COMPONENT OR SUBASSEMBLIES.
3. UNLESS OTHERWISE SPECIFIED, CAPACITANCE VALUES ARE IN MICROFARADS, RESISTANCE VALUES ARE IN OHMS.
4. D-INDICATES LEAD IS A JUMPER.
5. 2 TW-TWO WIRES SHALL BR TWISTED TOGETHER.

ISSUE CHANGES & REVISIONS

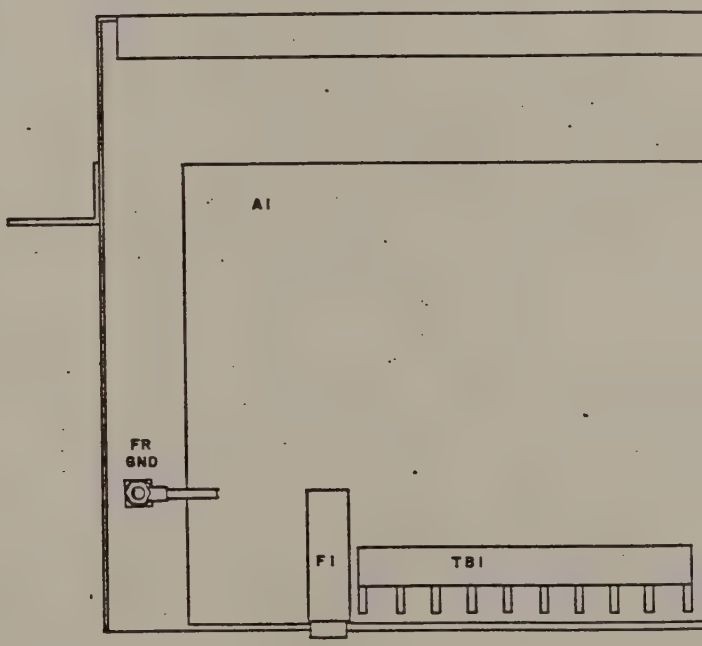
ISS NO.	REV	CHGD BY CHG ELP NO.	DATE	DESCRIPTION
1			OCT 25 1984 BR	NEW
				CONVERSION TO LAMPS
B1		1839182	11-14-85	J.R. REF. NUMBERS ADDED, COLORS REMOVED. K-8142 11-19-85 NOV 27 1985 BR T. Wanek 11-19-85 M

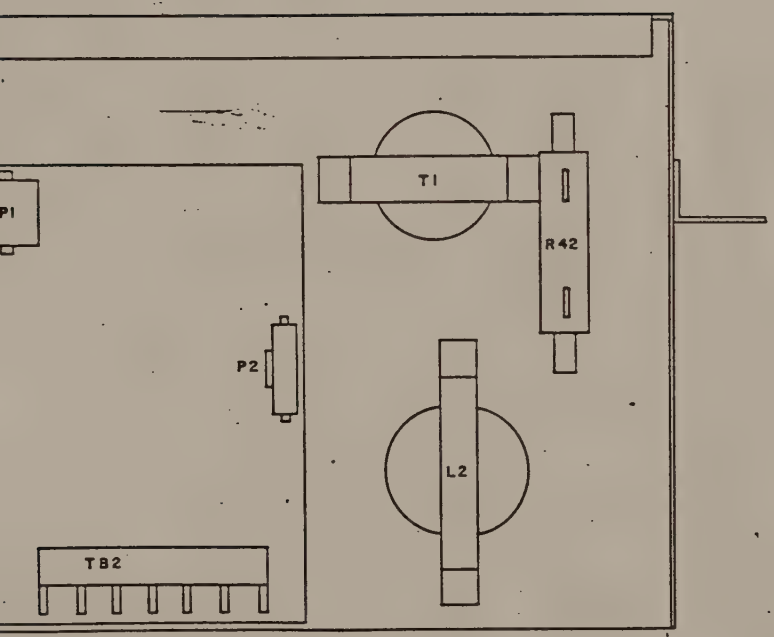


181-7282	DESIGN A. MARCUCCI	ISS B1
WIRING DIAGRAM FOR MODEL R82B	DRAWN BY J. REESE	DATE 10-2-84
	CHECKED BY A. MARCUCCI	DATE 12-3-84
	CHECKED BY E. STULLER	DATE 0-26-84
	APPROVED BY	DATE
	RATING STANDARD	
	T-5653-034-00	
LORAIN PRODUCTS LORAIN, OHIO RELIANCE COMM/TEC	DWG SIZE D	SHEET 1 OF 2

FIG.

PARTS LO





REV	DESCRIPTION	BY
1		M
B1		J.R. M

ISSUE B1

MODEL R82B	T-5653-034-00
LORAIN PRODUCTS / DWG SIZE D	SHEET 2 OF 2
	PRINTED IN U.S.A.

FOR PARTS OR SERVICE, CONTACT THE NEAREST

LORAIN REGIONAL SERVICE CENTER

OHIO REGIONAL SERVICE CENTER
1580 Iowa Avenue
Lorain, Ohio 44052
Telephone: 216/288-1122

TEXAS REGIONAL SERVICE CENTER
722 N. Great Southwest Parkway
Arlington, Texas 76011
Telephone: 817/640-1134

CONNECTICUT REGIONAL SERVICE CENTER
9-A Old Windsor Road
Bloomfield, Connecticut 06002
Telephone: 203/726-1990

SOUTHERN CALIFORNIA REGIONAL SERVICE CENTER
3001 Red Hill, Bldg. 6, Suite 109
Costa Mesa, California 92626
Telephone: 714/540-4395

ILLINOIS REGIONAL SERVICE CENTER
245 Roosevelt Road, Bldg. 7, Unit 49, 50
West Chicago, Illinois 60185
Telephone: 312/231-5775

NORTHERN CALIFORNIA REGIONAL SERVICE CENTER
2075 O'Toole Ave.
San Jose, California 95131
Telephone: 408/435-1303

GEORGIA REGIONAL SERVICE CENTER
5555 Oakbrook Parkway, Suite 540
Norcross, Georgia 30093
Telephone: 404/449-0840

CANADIAN SERVICE CENTER
122 Edward Street
St. Thomas, Ontario
Telephone: 519/631-0780

COLORADO REGIONAL SERVICE CENTER
4010 Youngfield Street
Wheat Ridge, Colorado 80033
Telephone: 303/422-6213

PACIFIC NORTHWEST SERVICE CENTER
15247 N.E. 90th Street
Redmond, Washington 98052
Telephone: 206/883-7912

LORAIN SERVICE® CAN ALSO PROVIDE:

Audio Visual Training Programs (Slide/Cassette)

- Battery Charger Maintenance - No. L302AV
- Storage Battery Maintenance - No. L301AV
- Central Office Ground Maintenance - No. L401AV

Factory or On-Site Training School

Specialized Test Equipment

- Ringing Generator Test Set - Model LS2000
  (Includes loads, metering, digital frequency counter)
- 130V Converter Test Load - Model LS1000
  (Variable loads to 6 amps)

Power Evaluation Program (PEP)

- Power analysis program for all central office power equipment including batteries.

Power Upgrade and Modernization Services

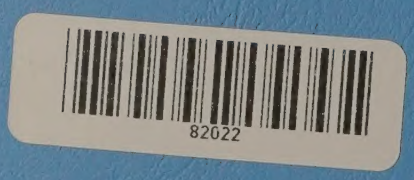
- Including engineering, fabrication and complete installation

Maintenance Contracts

Spare Parts Kits and Fuse Kits

Handy and practical, helps keep down time to a minimum.

Contact your nearest LORAIN Regional Service Center for more information.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